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Developing Genially-Based Interactive Learning Media to Enhance Motivation and Learning Outcomes of Grade XI Students on Reaction Rate Concepts

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Abstract: Chemistry in Indonesia continues to face persistent challenges related to student motivation and academic performance, particularly on abstract topics such as reaction rates. This study aimed to develop, validate, and evaluate a Genially-based interactive learning medium integrated within the Discovery Learning model for Grade XI students at SMAN 9 Pinrang. A Research and Development (R&D) approach was employed using the ADDIE model, encompassing five systematic phases: Analysis, Design, Development, Implementation, and Evaluation. The research subjects comprised 31 students of class XI.2. Data were gathered through structured interviews, questionnaires, expert validation sheets, and written learning outcome tests. The results demonstrated that: (1) the Genially interactive media was successfully developed across all five ADDIE phases, from needs and curriculum analysis through prototype design, expert validation, field implementation, and final evaluation; (2) the media achieved a validity rating of 3.70 out of 4.00 (92%), classified as highly feasible; (3) practicality was confirmed by teacher response scores of 97.08% and student response scores of 89%, both categorized as highly practical; and (4) effectiveness was evidenced by a substantial increase in student motivation from 61.70% to 96.19%, a class completion rate of 90%, and a mean post-test score of 90.65, surpassing the minimum mastery criterion of 80. These findings confirm that Genially-based interactive media represents a valid, practical, and effective instructional tool capable of meaningfully improving both motivational engagement and cognitive outcomes in secondary chemistry education.

Keywords: Interactive Media; Genially; Learning Motivation; Learning Outcomes; Reaction Rate

Introduction

The rapid acceleration of science and technology (IPTEK) in the twenty-first century has fundamentally reshaped virtually every domain of human activity, and education is no exception. Technology now serves as a principal conduit for expanding learning access, enabling students to engage with richer, more varied instructional resources through digital applications, video tutorials, and online platforms (Alam & Mohanty, 2023; Indarta et al., 2022). Within Indonesia's evolving educational landscape, the Merdeka Curriculum reinforces this trajectory by calling for learning experiences that are flexible, student-centred, and responsive to individual needs and interests. As Grimus (2020) argue, realising such a curriculum demands the purposeful integration of Information and Communication Technology (ICT) to support autonomous, anytime-anywhere learning.

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The urgency of this integration is further amplified by the generational profile of today's learners. Generation Z students—the cohort currently populating most classrooms—are regarded as digital natives: individuals who have grown up alongside the internet, social media, and mobile devices and who consequently exhibit markedly different learning preferences from their predecessors. They gravitate toward information presented in visual, interactive, and rapidly accessible formats, and they engage more effectively with gamified or multimedia-rich content than with conventional lecture-based instruction. These characteristics place an obligation on educators to design instructional strategies that harness digital technology optimally through interactive media, educational video, gamification, and web-based platforms—making technology integration not merely a contemporary aspiration but a pedagogical necessity aligned with genuine learner needs.

Nevertheless, the technological promise remains unevenly realised across Indonesia. Data released by the Ministry of Education, Culture, Research, and Technology (Kemendikbudristek, 2023) indicate that only 35% of Indonesian schools possess adequate digital infrastructure to support technology-driven learning. This structural deficit is compounded by low digital literacy among a portion of educators and an ingrained reliance on conventional pedagogical methods. Hussein et al. (2020) reported that merely 32% of teachers across Southeast Asia feel confident actively integrating digital technology into their instruction. Policy responses such as Regulation No. 40 of 2025 on Technology Utilisation in Learning have been issued, yet implementation remains constrained by resource shortfalls and insufficient teacher training. The result is a persistent gap between policy ambition and classroom reality, particularly in schools outside major urban centres.

This gap is concretely illustrated at SMAN 9 Pinrang, a public senior secondary school in Pinrang Regency that has adopted the Merdeka Curriculum. Pre-study interviews with the chemistry teacher and classroom observations revealed that instructional delivery in chemistry—particularly on the topic of reaction rates—continued to rely predominantly on textbooks and whiteboard-based lectures. The limited use of technology was confined to basic smartphone-assisted quizzes. Under these conditions, students reported finding chemistry abstract, monotonous, and difficult to engage with, which translated directly into below-minimum mastery criterion (KKM) scores across the cohort. A needs analysis questionnaire administered to students corroborated this picture: learners expressed strong preferences for more varied instructional media, specifically citing video lessons, animated graphics, and web-based learning platforms.

The disciplinary characteristics of chemistry magnify these challenges. As a subject that operates simultaneously at macroscopic, microscopic, and symbolic levels of representation, chemistry demands that students construct conceptual bridges across abstract and observable phenomena—a cognitive task that proves particularly demanding when instruction relies solely on verbal exposition (Baidoo, 2023; Kartini & Putra, 2020). Interactive media address this representational complexity by weaving together text, images, animations, and audio into coherent, multi-sensory learning experiences that activate multiple cognitive channels simultaneously, thereby deepening understanding and retention (Jannah et al., 2020; Nurhaliza et al., 2026).

Among the digital platforms that have garnered attention in the educational technology literature, Genially stands out for its versatility and accessibility. Founded in Spain in 2015, Genially is a web-based platform that empowers educators to design richly interactive instructional content—including presentations, infographics, educational games, interactive images, and video lessons—without requiring advanced technical expertise (Barrera & Maier, 2024). Its distinguishing features include an extensive library of customisable templates, real-time multi-author collaboration, automatic cloud saving, and the capacity to embed quizzes, video clips from YouTube and Spotify, and animated transitions within a single coherent interface (Abdulwahhab Ismail, 2025; Hermita et al., 2022). Crucially, Genially content can be accessed through any internet-connected device—smartphone, tablet, or computer—making it well-suited to school environments where students use personal devices during lessons (Rahmawati et al., 2023).

Empirical evidence supports the pedagogical effectiveness of Genially-integrated instruction. Kuncoro et al. (2025) found that Genially-based media was effective in elevating student learning motivation in secondary school science. Mayori et al. (2025) reported average validity scores of 4.26 (content) and 4.55 (media) for a Genially educational game developed around acid-base chemistry using a Problem-Based Learning framework, with practicality scores of 4.5—both classified as highly feasible. Soriano-Sánchez et al. (2026) documented improved cognitive learning outcomes among Grade X students following implementation of Genially-based gamification content, and Pradeep et al. (2024) confirmed the effectiveness of Genially combined with Discovery Learning in raising post-test achievement scores on the nervous system topic. These converging findings suggest that Genially's potential is neither discipline- nor topic-specific but reflects a broader instructional capability to support engagement-driven learning.

Given this context, the present study sought to develop a Genially-based interactive learning medium on the reaction rate topic for Grade XI MIPA students at SMAN 9 Pinrang and to assess its validity, practicality, and effectiveness in improving student motivation and learning outcomes. This article reports the full development process and evaluation results, contributing both a replicable development framework and empirical evidence for the integration of web-based interactive media within Indonesian secondary chemistry education.

Method

Research Design

This study adopted a Research and Development (R&D) paradigm with the objective of producing a validated instructional product. The development framework applied was the ADDIE model (Larson & Lockee, 2013), which organises the development process into five iterative phases: Analysis, Design, Development, Implementation, and Evaluation. ADDIE was selected because its systematic and iterative architecture ensures that the quality criteria of validity, practicality, and effectiveness are addressed comprehensively at each stage, and that feedback from any given phase can be used to refine both preceding and subsequent stages. The product developed was a Genially-based interactive learning medium for the chemistry topic of reaction rates, embedded within a Discovery Learning instructional model.

Research Setting and Participants

The study was conducted at SMAN 9 Pinrang, South Sulawesi, Indonesia, during the even semester of the 2025/2026 academic year. Research participants comprised 31 students enrolled in class XI.2, purposively selected as the implementation group. The school provides adequate ICT infrastructure—including desktop computers, projectors, internet access, and a chemistry laboratory—and permits student use of smartphones and laptops during lessons, making the site appropriate for trialling digital instructional media.

Development Procedure

Phase 1 — Analysis. The analysis phase comprised five interrelated sub-analyses: (a) needs analysis, conducted through direct classroom observation and semi-structured interviews with the chemistry teacher and selected students to identify learning problems and media preferences; (b) curriculum analysis, examining the Merdeka Curriculum's learning achievement targets (Capaian Pembelajaran) and learning objectives for reaction rates, guided by Permendikdasmen No. 13 of 2025; (c) instructional tool analysis, reviewing the existing resources deployed by the teacher; (d) learner analysis, profiling students' prior knowledge, technological literacy, and learning characteristics; and (e) content and learning objective analysis, mapping the conceptual scope of reaction rates to specific instructional objectives.

Phase 2 — Design. The design phase produced a prototype blueprint encompassing four activities: (i) content design—gathering and sequencing conceptual material on reaction rates in alignment with curriculum specifications; (ii) media design—constructing the Genially interactive environment including cover page, navigation guide, table of contents, instructional content slides, interactive quizzes, student worksheets (LKPD), practice exercises, and embedded videos and animations; (iii) instrument design—drafting validation sheets, teacher and student response questionnaires, learning motivation questionnaires, and a 20-item multiple-choice learning outcome test; and (iv) product mockup design—producing the initial visual layout using Genially's interface. All instruments were subsequently submitted to expert validators for review and refined based on their feedback before use.

Phase 3 — Development. During the development phase, the prototype was constructed on the Genially platform in accordance with the design specifications. Interactive elements—including clickable navigation buttons, embedded animations, background music, and linked quizzes—were incorporated and tested for functionality. The completed media was then submitted to two expert validators: Dr. Army Auliah, M.Si. (media expert) and Prof. Jusniar, S.Pd., M.Pd. (content expert), both from the Department of Chemistry, Faculty of Mathematics and Natural Sciences, Universitas Negeri Makassar. Validators assessed the media using structured rating sheets and provided written feedback for revision. The media was iteratively refined until both validators confirmed acceptability.

Phase 4 — Implementation. Following expert validation, the revised media was deployed in class XI.2 across a series of lessons on reaction rates. The researcher acted as facilitator, with the chemistry teacher present as observer. At the conclusion of instruction, teacher and student response questionnaires were distributed to measure practicality. Learning motivation was assessed using a 30-item Likert-scale questionnaire administered before (pre-motivation) and after (post-motivation) implementation. A 20-item multiple-choice post-test was administered to measure learning outcomes.

Phase 5 — Evaluation. Evaluation was embedded across all preceding phases as a formative process and was finalised in this phase through analysis of the accumulated validity, practicality, and effectiveness data. Summative evaluation centred on determining whether the media met the pre-established quality thresholds.

Data Collection Instruments

Four categories of instruments were used. Validity instruments consisted of structured expert validation sheets covering media quality (benefits, design, and navigation/operation) and content quality (alignment with learning objectives, content accuracy, content presentation, language, and self-evaluation features). Practicality instruments comprised separate Likert-scale questionnaires for teachers and students, each calibrated on a four-point scale (4 = Strongly Agree to 1 = Strongly Disagree). Effectiveness instruments included a 30-item learning motivation questionnaire rated on a four-point scale (4 = Strongly Agree to 1 = Strongly Disagree), and a 20-item multiple-choice learning outcome test aligned with the curriculum's learning objectives. All instruments were validated by expert panels before field use.

Data Analysis

Validity data were analysed by computing the mean score across all validator ratings for each aspect, then for the overall instrument. Scores were classified using the criteria established: 3.5–4.0 = highly valid; 3.0–3.4 = valid; 2.5–2.9 = moderately valid; 1.5–2.4 = less valid; 1.0–1.4 = invalid. Feasibility percentages were additionally computed and interpreted against a five-tier scale: 81–100% = highly feasible; 61–80% = feasible; 41–60% = moderately feasible; 21–40% = less feasible; 0–20% = infeasible (Arikunto, 2013).

Practicality data were converted from Likert scores to percentages using the formula: percentage = (obtained score / maximum score) × 100%. Results were interpreted against practicality qualification criteria: 80–100% = highly practical; 60–79% = practical; 50–59% = less practical; <50% = not practical. Effectiveness was assessed through two measures: (1) the pre-to-post increase in motivation scores, expressed as percentages and interpreted using categorisation criteria 81–100% = very high; 61–80% = high; 41–60% = moderate—supplemented by the normalised gain (N-Gain) index (Meltzer & David, 2002): $g > 0.7$ = high; $0.3 \leq g \leq 0.7$ = medium; $g < 0.3$ = low; and (2) the percentage of students achieving or exceeding the minimum mastery criterion (KKM) of 80. Effectiveness was deemed achieved when at least 85% of students attained the KKM.

Result and Discussion

Development Process of the Genially Interactive Media

The development process unfolded systematically through the five ADDIE phases, each yielding specific outputs that informed the next. The analysis phase revealed critical problems in the instructional ecology at SMAN 9 Pinrang: the chemistry teacher's instruction was predominantly delivered via whiteboard and basic PowerPoint slides, and the only technology-mediated activity was smartphone-based interactive quiz completion. Students expressed low motivation toward chemistry, attributing their disengagement to the abstract and monotonous nature of the instructional content. The needs analysis questionnaire confirmed that learners preferred media incorporating video, animation, and website-based access—precisely the capabilities that Genially affords. Curriculum analysis established that the school had adopted the Merdeka Curriculum and that reaction rates constituted a substantive, conceptually dense topic requiring multi-representational treatment to bridge macroscopic observations, microscopic particle behaviour, and symbolic notation.

The design phase translated these findings into a structured media blueprint. The media was conceived as a self-navigating digital environment accessible via smartphones and laptops, aligned with Discovery Learning's principle that students should construct understanding through guided inquiry rather than passive reception. The content architecture included a cover page with a navigation launch button, a usage guide, a table of contents, topic-specific content slides integrating animations and embedded video, interactive quizzes, a digital student worksheet (LKPD), supplementary practice items, and related video resources. This scaffold encourages learners to engage with each element progressively, promoting cognitive activation and self-directed discovery.

During the development phase, the media was constructed on the Genially platform. Key production steps included the creation of the cover page (halaman pembuka) with a start button, the assembly of interactive content pages featuring layered animations and clickable elements, the embedding of navigational interactivity throughout, and the publication of the finished product for online access. Expert validators reviewed the completed prototype and recommended one substantive revision: the removal of the qualifier 'slightly slow' from the stimulus section, as no comparative frame of reference was provided in the media to give this descriptor meaning. This revision was implemented before field testing.

Implementation involved deploying the revised media in the class XI.2 learning environment. Students accessed the Genially media through personal smartphones and school-provided computers while the teacher facilitated Discovery Learning stages. Feedback from observers—two chemistry teachers at SMAN 9 Pinrang—and from student questionnaires informed incremental refinements during and after lessons. The evaluation phase culminated in a formal assessment of all collected data against the validity, practicality, and effectiveness benchmarks described in the method section.

Validity of the Genially Interactive Media

Expert validation yielded highly favourable assessments of both the media and content quality. Table 1 summarises the results of media expert validation.

The media expert assigned mean scores of 3.70 (benefits), 3.60 (design), and 3.80 (navigation/operation), yielding an overall mean of 3.70 out of 4.00, which falls within the 'highly valid' range ($3.5 \leq X \leq 4.0$) and corresponds to a feasibility percentage of 92%—classified as 'highly feasible.' Table 2 presents the corresponding content expert results.

Table 1. Expert validation results media quality

Aspect	Mean Score	Category
Media Benefits	3.70	Highly Valid
Media Design	3.60	Highly Valid
Navigation / Operation	3.80	Highly Valid
Overall Mean	3.70	Highly Valid

Table 2. Expert validation results — content quality

Aspect	Mean Score	Category
Alignment with Learning Objectives	3.50	Valid
Content Quality	3.40	Valid
Content Presentation	3.40	Valid
Language	3.50	Valid
Self-Evaluation Presentation	3.30	Valid
Overall Mean	3.43	Valid

The content expert rated all five content dimensions—alignment with learning objectives (3.50), content quality (3.40), content presentation (3.40), language (3.50), and self-evaluation features (3.30)—within the valid range, producing an overall mean of 3.43. The accompanying supporting instruments also attained satisfactory validity: the learning outcome test achieved 3.48 (valid); the student worksheet (LKPD) 3.56 (highly valid); the student response questionnaire 3.57 (highly valid); the learning motivation questionnaire 3.53 (highly valid); and the teacher response questionnaire 3.50 (valid). Collectively, all media components and their supporting instruments were confirmed as valid by both validators, providing a sound foundation for field implementation.

These findings align with prior Genially-based research. Validity scores of 4.26 and 4.55 for content and media aspects respectively in their Genially educational game for acid-base chemistry—both considerably above the acceptable threshold—indicating that properly designed Genially media can meet stringent expert quality standards. The validity of the present media reflects careful adherence during the design phase to curriculum specifications, content accuracy, and principles of interactive media design (Ristiani & Hermita, 2022).

Practicality of the Genially Interactive Media

Practicality was evaluated through two groups: the chemistry teachers who observed implementation and the students who used the media. Table 3 displays teacher response data.

Table 3. Teacher response questionnaire results

Respondent	Mean Percentage (%)	Category
Teacher 1	97.50	Highly Practical
Teacher 2	96.68	Highly Practical
Overall Mean	97.08	Highly Practical

Both teachers evaluated the media as highly practical, with individual scores of 97.50% and 96.68%, yielding a combined mean of 97.08%—well within the 'highly practical' threshold of 80–100%. Student response data were equally encouraging, with a collective mean score of 89%, also classified as highly practical. These figures indicate that both the teachers who implemented the media and the students who interacted with it perceived it as easy to use, functionally reliable, and effectively suited to the learning context.

High practicality scores for Genially media are consistent with its design philosophy. The platform's user-friendly interface, automatic saving, device-agnostic access, and rich template library reduce cognitive and logistical barriers for both educators and students. The ability to access Genially content on a smartphone without downloading dedicated software is especially pertinent in the Indonesian context, where smartphone penetration exceeds access to full desktop computing equipment in many schools. That teachers rated the media as slightly more practical than students (97.08% vs. 89%) may reflect differences in evaluative focus: teachers may have weighted the media's ease of preparation and classroom management properties more heavily, whereas students' somewhat lower scores might indicate occasional navigation challenges or variability in personal device performance. Neither result, however, falls below the highly practical threshold, affirming the media's readiness for broader deployment.

Effectiveness of the Genially Interactive Media

Effectiveness was assessed along two dimensions: the enhancement of student learning motivation and the improvement of learning outcomes on the post-test.

Table 4. Student learning motivation results (pre- and post-implementation)

Class	Pre-Motivation (%)	Post-Motivation (%)	Category (Post)
XI.2	61.70	96.19	Very High

Table 4 reveals a substantial and educationally meaningful improvement in student motivation: the pre-implementation score of 61.70% (categorised as 'high' under the 61–80% band) climbed to 96.19% post-implementation (categorised as 'very high' under the 81–100% band). The normalised gain (N-Gain) index of 0.91 confirmed that this improvement was substantial, falling firmly within the 'high' category ($g > 0.7$). Table 5 presents learning outcome data.

Table 5. Student learning outcome results

Class	KKM	Class Completion (%)	Mean Score
XI.2	80	90.00	90.65

Student learning outcomes were equally impressive: 90% of the 31 students in class XI.2 attained or exceeded the KKM of 80, surpassing the 85% benchmark for declaring a learning medium effective. The class mean score of 90.65 also exceeded the KKM by a comfortable margin, confirming that the media had succeeded not merely in bringing marginal learners to threshold but in lifting overall cognitive achievement. Both effectiveness indicators—motivational enhancement and mastery rates—thus met or exceeded their respective criteria.

The motivational gains recorded in this study merit critical interpretation. Prior to implementation, a majority of students in class XI.2 reported limited intrinsic engagement with chemistry, reflecting the absence of varied, visually stimulating instructional materials and the pervasive sense that chemistry content is inherently inaccessible. The Genially media disrupted this status quo by embedding learning content within an aesthetically engaging, interactively navigable digital environment. Theoretical grounding for this outcome: interactive technology-based learning environments have been shown to substantially increase learner engagement, interest, and motivation by capitalising on students' preference for digital interaction and their tendency to sustain attention when content is presented in dynamic, non-linear formats. Genially implementation in senior secondary classrooms reliably produced motivational gains, corroborating the present findings.

The Discovery Learning framework within which the Genially media was deployed is also worth foregrounding as a contributing factor to both motivational and cognitive outcomes. Discovery Learning engages students as active knowledge constructors: they are guided through inquiry, problem-posing, and conceptual discovery rather than simply receiving information. When Genially's interactive affordances—clickable content elements, branching navigation, embedded quizzes, and animated demonstrations of reaction mechanisms—are scaffolded within a Discovery Learning sequence, the resulting instructional experience is qualitatively richer than either component alone could produce. Students encounter animated representations of reaction rate concepts (e.g., particle collision frequency, activation energy, concentration gradients), immediately test their understanding through embedded quizzes, and revisit material through navigational autonomy, all within a single cohesive digital artefact. Discovery Learning enhances learner activeness and motivation, that its combination with Genially specifically improves post-test cognitive outcomes on science topics with high abstraction levels—a profile that fits reaction rates precisely.

The 90% class completion rate recorded in this study—exceeding the predefined 85% threshold—also warrants contextualisation. Before the intervention, student performance on chemistry assessments routinely fell below the KKM of 80, reflecting both motivational disengagement and conceptual misunderstanding. The post-test mean of 90.65 indicates that the media enabled students not only to reach the minimum criterion but to demonstrate consolidated understanding of reaction rate concepts. This improvement is consistent with theoretical propositions in the interactive media literature: when textual and visual information are presented in integrated, multi-sensory formats with immediate interactive feedback mechanisms, learners process and retain material more effectively than through either channel in isolation (Chen, 2018). Analogous improvements in cognitive achievement following Genially-based gamification intervention in Grade X chemistry, suggesting that the effectiveness pattern documented here is generalisable across chemistry topics and cohorts.

One limitation of this study warrants acknowledgement. The implementation was conducted with a single class ($n = 31$) in a single school, without a control group. While the pre-post motivational comparison and the post-test completion rate provide robust evidence of practical effectiveness, the absence of a comparison condition means that the causal contribution of the Genially media—as distinct from broader contextual factors such as novelty effects, teacher enthusiasm, or seasonal variation—cannot be definitively isolated. Future research should consider quasi-experimental designs with matched control groups and should extend implementation across multiple schools and student cohorts to test the generalisability of these outcomes. Additionally, expanding the topical scope beyond reaction rates to other abstract chemistry topics such as chemical equilibrium, electrochemistry, or organic mechanisms would help establish the breadth of Genially's pedagogical applicability in Indonesian secondary chemistry education.

Conclusion

This study demonstrates that a Genially-based interactive learning medium developed through the systematic ADDIE framework constitutes a valid, practical, and effective instructional resource for Grade XI chemistry instruction on the topic of reaction rates. The development process—spanning needs analysis, prototype design, expert validation, field implementation, and evaluative synthesis—yielded a media product that earned strong endorsement from content and media experts (overall validity mean of 3.70, 92% feasibility), high practicality ratings from both teachers (97.08%) and students (89%), and substantial effectiveness evidence through a motivational increase from 61.70% to 96.19% (N-Gain = 0.91), a class completion rate of 90%, and a mean post-test score of 90.65. These findings carry clear practical implications for chemistry educators in Indonesian secondary schools. Genially offers a readily accessible, technically manageable, and pedagogically rich platform that teachers can leverage to transform conventionally abstract content into engaging, multi-representational learning experiences—without requiring advanced programming skills or substantial financial investment. For school administrators, the results advocate for institutional support of digital media initiatives through sustained ICT infrastructure provision, professional development on interactive media design, and policies that enable student device use during instruction. For researchers and curriculum developers, this study adds to a growing evidence base affirming that well-designed web-based interactive media, when aligned with constructivist instructional frameworks such as Discovery Learning, can meaningfully close the gap between chemistry's inherent conceptual abstraction and students' cognitive accessibility.

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Author Contributions

Conceptualization, A.M.; methodology, A.M.; software, A.M.; validation, M.M. and M.W.; formal analysis, A.M.; investigation, A.M.; resources, A.M.; data curation, A.M.; writing—original draft preparation, A.M.; writing—review and editing, M.M. and M.W.; supervision, M.M. and M.W. All authors have read and agreed to the published version of the manuscript.

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Conflicts of Interest

The author declares no conflict of interest.

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